

REMARKS

Reconsideration of the above-identified patent application, as amended, is respectfully requested.

Claim 19 has been amended to recite the method claim in gerund form according to U.S. practice and to more clearly define applicant's invention. As amended, the method recites the steps of forming the suspension bar from an outer jacket tube consisting essentially of acid-resistant steel or stainless steel and a highly electroconductive core consisting essentially of copper or aluminum by casting the core in molten form inside the outer jacket tube for a time sufficient to form a metallurgical bond between the outer jacket and the core, and then machining the outer jacket partially open from at least one end of the suspension bar to expose the core. Support for this Amendment is found in former Claim 19; at page 4, lines 21-25; and page 6, lines 6-12 of the Specification.

Dependent Claims 11-17 also have been amended to recite and/or further define the method steps of the claimed invention in gerund form. Full support for Claims 11-17 as amended is found in original Claims 11-17 and in the specification at page 6, line 6 to page 7, line 3. Claim 22 has been amended to recite that the outer jacket consists essentially of stainless steel. New Claims 23-26, dependent directly or indirectly from Claim 19, have been added and are directed to embodiments of applicant's claimed invention. Support for new Claims 23-26 is found in the specification at page 4, lines 28-29 and page 6, lines 14-31.

Former Claims 11-14 have been rejected under 35 U.S.C. 112, second paragraph, as being indefinite for reciting "a rigid metal outer jacket" and "a refined steel outer jacket." Office Action dated November 14, 2003, p.2. Claims 19 and 11-17 have been amended to recite

that the outer jacket tube consists essentially of an acid-resistant steel or stainless steel. Because the objected to terms no longer appear in Claims 11-14 as amended, the amended claims are believed to have removed the basis for the rejection applied to former Claims 11-14 under 35 U.S.C. 112, second paragraph, as being indefinite. Withdrawal of such rejection is respectfully requested.

As now claimed, applicant's invention is directed to a method for manufacturing a suspension bar for a permanent cathode used in an electrolysis of metals. The method comprises forming the suspension bar from an outer jacket tube consisting essentially of acid-resistant steel or stainless steel and a highly electroconductive core consisting essentially of copper or aluminum by casting the core in molten form inside the outer jacket tube for a time sufficient to form a metallurgical bond between the outer jacket and the core, and then machining the outer jacket partially open from at least one end of the suspension bar to expose the core.

Former Claims 19, 14 and 22 have been rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 4,647,358 to Bartsch ("Bartsch"), in view of U.S. Patent No. 3,648,757 to Willingham ("Willingham"). Bartsch describes a current-feeding cathode mounting device for the electrolytic refining of copper that includes a permanent cathode and a hollow copper pipe that is placed inside a steel sheath. In the method of manufacture described by Bartsch, the outer jacket (the steel sheath) is initially split longitudinally. Later, the copper pipe is inserted into the sheath (2), and the sheath is welded closed. See Bartsch, column 2, lines 38-57 and column 3, lines 9-13. Bartsch is clearly deficient as the Office Action acknowledges that "Bartsch does not disclose a method of joining the parts by casting." Office Action dated November 14, 2003, p.3.

Bartsch is further removed from Claim 19, as amended, and does not teach or suggest forming the suspension bar from an outer jacket tube consisting essentially of acid-resistant steel or stainless steel and a highly electroconductive core consisting essentially of copper or aluminum by casting the core in molten form inside the outer jacket tube for a time sufficient to form a metallurgical bond between the outer jacket and the core, and then machining the outer jacket partially open from at least one end of the suspension bar to expose the core.

The Office Action argues that "Willingham teaches a method of attaching the core, which is the metal being poured, to jacket 16 by casting it in molten form as shown in Figure 4." According to the Office Action, "It would have been obvious to provide a method of fixedly attaching the core to the jacket by casting it in molten form in Bartsch as taught by Willingham in order to mold the core to jackets of various shapes and sizes." See Office Action dated November 14, 2003, p.3. However, if molten metal were poured into the split outer jacket of Bartsch, ^{It's welded shut.} the molten metal would undoubtedly leak out and be wasted, a structural deficiency inherent in the teachings of Bartsch that teaches away from the combination of Bartsch with Willingham.

Willingham does not remedy the deficiencies of Bartsch. Willingham describes making a multi-layer mold for iron pipe manufacturing. A mandrel 10, which has the configuration of the pipe to be cast, is first applied with a coating such as tin or lead to a thickness of 0.0005 in. After that, a low-stress material such as nickel, copper or cobalt is electro-deposited on the coating. The electro-depositing is continued until a sleeve 15 is formed on the mandrel. The mandrel with the sleeve thereon is placed within a form 16, which functions as a mold. A molten metal like aluminum, magnesium or the like is poured around the mandrel,

between the mandrel and the form/mold (16) and allowed to harden to form an outer layer.

Later, the assembly (including metal 18) is removed from the form (16). See Willingham col. 3, lines 54-55, 63-64, 69-72 and col. 4, lines 8-10. In short, Willingham describes forming the jacket onto the *outside* of a "core" by casting.

In addition, Willingham does not teach or suggest forming a metallurgical bond between the core and the jacket because, as shown in Fig. 6, the core can be separated from and removed from the jacket 16. The Office Action dated June 3, 2003 at page 6 argued that "Willingham does teach that the outer jacket and the core are joined together in order to obtain a metallurgical bond by casting a core in molten form inside a jacket. Willingham shows the jacket 16 and the core in molten form being poured in to the jacket in Fig. 6. Although the jacket 16 is removed from the core as shown in Fig. 6, a metallurgical bond was formed because the core and the jacket are united in one solid piece as shown in Fig. 5 (pg. 5, last line to pg. 6, line 6)."

The term "metallurgical bond" is a nonstandard term for "metallic bond." The term means that the metals or pieces which form a metallurgical bond cannot separate from each other in the same way that the mold/form 16 and the metal 18 of Willingham separate from each other. Appended to this Amendment and Response is a copy of Thermal Spray Technology Glossary (enclosure 1) and a copy of selected articles, which describe the nature of a metallurgical bond. Such bonds form, for example, when galvanizing between zinc and steel products (enclosures 2 and 3), in bi-metallic transition joints (enclosure 4), or in plasma jet welding (enclosure 5). As can be seen in these appended documents, physically detaching zinc from a galvanized product would be impossible.

To achieve a good electroconductive contact between the core and the jacket in applicant's method, the core and the jacket must form a metallurgical bond with each other. As claimed by applicant, since a metallurgical bond is formed between the core and the outer jacket, the outer jacket *cannot* be separated from the core. Applicant's method thus recites that the outer jacket is machined partially open, thereby exposing the core in at least one end of the suspension bar. Willingham's removal of the molded assembly (18 and 15) from the form 16 does not teach or suggest removal by machining of part of the outer jacket to expose the core, as now claimed by applicant.

not saying
it does
Bartsch
removes outer
jacket in
column 2
lines 31-60
"Machined"
is new

Moreover, even if improperly combined, the combination does not teach or suggest casting the core in molten form inside the outer jacket tube for a time sufficient to form a metallurgical bond between the outer jacket and the core, as now claimed by applicant.

Since neither Bartsch nor Willingham, alone or in combination, teach or suggest each and every element of amended Claim 19, Applicant respectfully submits that amended Claim 19 defines patentable subject matter thereover. Since Claims 14 and 22 depend from Claim 19, they also patentably distinguish over Bartsch and Willingham. Withdrawal of the rejection applied to former Claims 19, 14 and 22 under 35 U.S.C. §103(a) as being unpatentable Bartsch, in view of Willingham, is respectfully requested.

Former Claims 11 and 12 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Bartsch in view of Willingham, further in view of U.S. Patent No. 3,780,555 to Balthazar et al. ("Balthazar"). Amended Claims 11 and 12 depend from Claim 19. The deficiencies of Bartsch and Willingham have been set forth above. Neither Bartsch nor Willingham teach or suggest a method for manufacturing a suspension bar wherein "the core is

fixedly attached to the jacket by casting it in molten form inside the solid jacket” or forming a “metallurgical bond between the outer jacket and the core, and then machining the outer jacket partially open from at least one end of the suspension bar to expose the core.” Balthazar does not remedy the deficiencies of these references.

Balthazar describes a method for preparing seamless pipes for nuclear power plants by centrifugal casting. The centrifugal casting system includes a casting die (13), a cylindrical tube, which is rotated and into which molten pipe metal is poured. The casting die is provided with a preheater (35). However, preheating of a casting die does not teach or suggest heating of the jacket before or during bonding with the core by casting the core in molten form inside the solid jacket, as recited in Claims 11 and 12, respectively, since Balthazar does not attempt to fixedly attach the die (13) with the pipe preform (37).

Moreover, Balthazar does not teach or suggest a method for manufacturing a suspension bar comprising “casting the core in molten form inside the outer jacket tube for a time sufficient to form a metallurgical bond between the outer jacket and the core, and then machining the outer jacket partially open from at least from one end of the suspension bar to expose the core,” as recited in amended Claim 19.

For these reasons, Applicant respectfully submits that Claims 11 and 12, as amended, define patentable subject matter over Bartsch, Willingham and Balthazar, alone or in combination. Withdrawal of the rejection applied to former Claims 11 and 12 under 35 U.S.C. §103(a) as being unpatentable over Bartsch in view of Willingham, further in view of Balthazar is respectfully requested.

Former Claim 13 has been rejected under 35 U.S.C. §103(a) as being unpatentable over Bartsch in view of Willingham, further in view of JP 01180718 to Yamada et al. ("Yamada"). Claim 13, as amended, depends from Claim 19. The deficiencies of Bartsch and Willingham, in teaching or suggesting the subject matter of Claim 19, have been set forth above. Yamada does not remedy these deficiencies.

Yamada describes forming a duplex tube wherein the tubes are fitted to each other by centrifugally casting the inner tube inside the outer tube. After the inner tube is cooled, an induction heating device and a water shower are integrated and moved in an axial direction in order to tighten the connection between the tubes.

However, Yamada does not teach or suggest a method for manufacturing a suspension bar in comprising "casting the core in molten form inside the outer jacket tube for a time sufficient to form a metallurgical bond between the outer jacket and the core, and then machining the outer jacket partially open from at least from one end of the suspension bar to expose the core," as recited in amended Claim 19.

For these reasons, Applicant respectfully submits that Claims 19, as amended, defines patentable subject matter over Bartsch, Willingham and Yamada, alone or in combination. Since Claim 13 depends from Claim 19, it also patentably distinguishes over Bartsch, Willingham and Yamada, alone or in combination. Withdrawal of the rejection applied to former Claim 13 under 35 U.S.C. §103(a) as being unpatentable over Bartsch in view of Willingham, further in view of Yamada is respectfully requested.

Former Claims 15 and 16 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Bartsch in view of Willingham, further in view of U.S. Patent No. 4,807,688

to Beetle ("Beetle"). Claims 15 and 16 depend from Claim 19. The deficiencies of Bartsch and Willingham have been set forth above. Beetle does not remedy these deficiencies. Beetle describes a process for forming metal objects using a submerged mold. Beetle does not teach or suggest a method for manufacturing a suspension bar comprising "casting the core in molten form inside the outer jacket tube for a time sufficient to form a metallurgical bond between the outer jacket and the core, and then machining the outer jacket partially open from at least from one end of the suspension bar to expose the core," as recited in amended Claim 19.

For these reasons, Applicant respectfully submits that Claim 19, as amended, defines patentable subject matter over Bartsch, Willingham and Beetle, alone or in combination. Since Claims 15 and 16 depend from Claim 19, they also patentably distinguish over Bartsch, Willingham and Beetle, alone or in combination. Withdrawal of the rejection applied to former Claims 15 and 16 under 35 U.S.C. §103(a) as being unpatentable over Bartsch in view of Willingham, further in view of Beetle is respectfully requested.

Former Claims 15 and 17 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Bartsch in view of Willingham, further in view of U.S. Patent No. 5,005,631 to Dwivedi ("Dwivedi"). Claims 15 and 17 depend from amended Claim 19. The deficiencies of Bartsch and Willingham have been set forth above. Dwivedi does not remedy these deficiencies. Dwivedi describes a method for forming a metal matrix composite body. In Dwivedi, a permeable mass preform body, such as slip cast silicon carbide, is placed into contact from its external surface with molten matrix metal like aluminum. During contact, the molten matrix metal infiltrates the preform. The preform is in an upright position in the refractory vessel during the infiltration, but the preform body is not totally immersed into the matrix metal.

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Dwivedi does not teach or suggest a method for manufacturing a suspension bar comprising "casting the core in molten form inside the outer jacket tube for a time sufficient to form a metallurgical bond between the outer jacket and the core, and then machining the outer jacket partially open from at least from one end of the suspension bar to expose the core," as recited in amended Claim 19. For these reasons, Applicant respectfully submits that Claim 19, as amended, defines patentable subject matter over Bartsch, Willingham and Dwivedi, alone or in combination. Since Claims 15 and 17 depend from Claim 19, they also patentably distinguish over Bartsch, Willingham and Dwivedi, alone or in combination. Withdrawal of the rejection applied to former Claims 15 and 17 under 35 U.S.C. §103(a) as being unpatentable over Bartsch in view of Willingham, further in view of Dwivedi is respectfully requested.

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CONCLUSION


In light of the foregoing, Applicant respectfully submits that all claims, as currently presented, define patentable subject matter over the prior art of record. An early allowance of all claims is earnestly solicited.

Respectfully submitted,

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